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A COMPARISON OF TEXTS AND THEIR SUMMARIES: MEMORIAL CONSEQUENCE--ETC(U)
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**A COMPARISON OF TEXTS
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MEMORIAL CONSEQUENCES**

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↙ Chapters from college textbooks in diverse fields were compared with summaries constructed to convey the main points. A series of studies demonstrate consistent advantages for summaries. Summaries maintained their advantages at retention intervals of 20 minutes, 1 week, and 6 to 12 months. Summaries were superior both for questions directly taken from the text and for inference questions that required the subject to combine facts that had been studied. A transfer task looked at ability to learn new, related material as a function of how the previous material was learned. Summaries yielded better transfer. Reaction time differences showed the same pattern as percent correct. Summaries maintained their superiority even when the main points in the text were underlined. ↗

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Abstract

Chapters from college textbooks in diverse fields were compared with summaries constructed to convey the main points. A series of studies demonstrate consistent advantages for summaries. Summaries maintained their advantages at retention intervals of 20 minutes, 1 week, and 6 to 12 months. Summaries were superior both for questions directly taken from the text and for inference questions that required the subject to combine facts that had been studied. A transfer task looked at ability to learn new, related material as a function of how the previous material was learned. Summaries yielded better transfer. Reaction time differences showed the same pattern as percent correct. Summaries maintained their superiority even when the main points in the text were underlined.

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A typical college text contains about 400 pages of text and about a 150,000 words. No educator seriously believes that a student will commit all 150,000 words to memory verbatim. What then, do the author and teacher expect the student to remember? In part, the text is intended to communicate a certain set of skills for reasoning or thinking cogently within that field. However, another important function of the text, judging from typical examination questions, is to communicate facts.

If one counts the number of propositions in a textbook, most modern texts contain tens of thousands of facts. No teacher can seriously expect the student to retain all of these facts. A number of cognitive scientists have proposed theories of the structure of text (e.g., Crothers, 1972; Frederiksen, 1975; Kintsch, 1974; Kintsch and van Dijk, 1975; Mandler and Johnson, 1977; Meyer, 1975; Rumelhart, 1975; Stein and Glenn, in press; Thorndyke, 1977) and these analyses imply which facts are more likely to be retained. The predominant analysis of text has structured the propositions or idea units hierarchically where the more central or important propositions are represented higher in the hierarchy. Investigations of these representations have found that propositions higher and more central in these hierarchies are better recalled, more accurately recognized, and more rapidly verified (e.g., Kintsch, 1974; Kintsch and van Dijk, 1976; Meyer, 1975).

These results suggest that memory for text nicely meshes with a writer's communicative intent. The main points are best remembered and these are the propositions that the writer most wants remembered. One might wonder whether this coincidence is accidental or causal. It might be that the reader implicitly recognizes the importance of the central points and assigns greater capacity to their processing. Or it might be that main points, due to their position in the logical structure within a text, are better remembered even when amount of processing time is controlled. Meyer and McConkie (1973) report that centrality in a hierarchy is a better predictor of recall than a subject's rating of importance of propositions. This suggests that better memory for certain propositions is due to logical structure and not a subject's perception of importance.

Function of Details

From the notions presented thus far, it is difficult to make a case for the inclusion of details in texts. Although the hierarchical text theories have not explicitly committed themselves on this issue, one would think that the detailed propositions under a main point would not have a facilitative effect in memory for prose. Assuming such hierarchies are searched in a top-down manner, access to the details depends on getting the main points but there would be no dependence of main points on details. If anything, details should take study time away from the main points. Also, to the extent that subjects have difficulty in identifying the main points in a text, inclusion of details would tend to interfere with the extraction of the central ideas.

Of course, there are probably many arguments that can be made for why students read the long, detailed version of a text rather than a summary. For one thing, while the writer cannot seriously expect the student to retain all of the text, some of the details will probably be retained and provide illustrations and expansions of the main points.

Another goal of the inclusion of details is to acquaint the student with the argument structure of the field. Even if a student does not remember specific arguments, he or she may still be able to abstract the type of argument used and thereby regenerate it at some future time.

These potential functions of details, however, do not address the issue of whether details support the memory for the main points of a text. If the principal educational function of a text were to communicate the central facts, would the author be justified in including details? One argument that can be made is that embellishments allow the reconstruction of the main points. That is, the details imply the main points although the converse is not true. This position is in implicit opposition to the hierarchical theories as described above. If one views memory for a text as a network structure rather than as a strict hierarchy of propositions, recall of details allows access to the main points to which those details are connected. When the main points are forgotten, one can still infer or reconstruct the main points from the

details that imply them. Consider the following three sentences that are found in one of the introductory chapters we used in some of our experiments. First, there is a general statement:

- (1) Africa has had less rapid development in the 1960's than the 1950's.

statements

Second, we have two ~~states~~ at a level of detail below this general statement:

- (2) There were decreases in administrative efficiency associated with the move from colonial to independent status in many countries.
- (3) In the 1960's, there was an unwise emphasis on manufacturing at the expense of agriculture.

*that details support memory
of the main points*

Sentences (2) and (3) imply (1), but not vice-versa. This position can be dubbed the redundancy hypothesis.

To summarize, listed below are the arguments for excluding details when trying to maximize acquisition of important points:

- (1) There are tens of thousands of facts in a text; we can not expect students to memorize all of these facts and they don't.
- (2) Students will have to time share, that is, devote some of their processing time to unimportant facts.
- (3) It is harder for readers to appreciate or extract the important points if they are embedded in details.
- (4) Hierarchical analyses of text-structure assert that details are subordinate in the representation to the main points and therefore can not help the student remember the main points. Access to the details is through the higher level nodes and thus dependent on recovering the main points.

The arguments for including details in an attempt to maximize acquisition of important points can be summarized as follows:

(0) Details may provide needed arguments to convince the reader of the verity of an assertion. However, this and other functions of illustration are not relevant to the discussion of how to best learn specific facts. Thus we have called this reason 0.

(1) Embellishments may allow the reconstruction of the main points. The details imply the main points although the converse is not true.

(2) Sometimes access to central points may only be available via some details.

We were inclined to believe this second point of view given the importance we attribute to elaboration in other contents (Anderson, 1976; Anderson and Reder, 1979; Reder, 1976; 1979). In an informal pole of colleagues we also found that the much more frequent prediction was that text would prove to be better than summary--at least at delayed testing.

EXPERIMENTS 1 and 2

To discover whether inclusion of details is advantageous or not, we decided to perform a pair of experiments that would test subject's memory for information acquired via text and via summaries immediately after study and at a delay of one week. The two experiments differ only in the amount of study time, so they will be described together. Two standard introductory college texts were selected as the basic material, one An Introduction to Descriptive Linguistics by Gleason (1967), the other The Geography of Modern Africa by Hance (1975). Neither text requires prior knowledge on the part of the student in that content area. In both cases, Chapter 1 was the material students studied. Summaries were written for both chapters. These summaries were roughly one-fifth the length of the originals and were about 1000 words long. The questions we chose to ask the subjects could all be answered on the basis of the summaries. The questions were true-false and half of the

trues and half of the falses could be answered by retrieving a simple assertion provided in the summary. The other half required that the reader combine statements presented in the summary. The former type are called direct questions; the latter, indirect questions.

Method

Materials

The text material had been photocopied from the original textbooks. The summaries were written to restate the main points in as compact a fashion as possible. The critical sentences were typed on plain sheets of paper, keeping the section headings of the original text. No paragraph structure or interstitial material was maintained, however. Each sentence started on a new line. The African Economic Geography text was approximately 4300 words and its summary 1000 words. The linguistic text was about 4900 words and its summary 800 words.

For each topic, 32 questions were written, half interrogating specific assertions in the material (direct questions) and half requiring integration of several points (indirect questions). To facilitate collection of reaction times, the items required only simple true-false decisions. Half of the direct and half of the indirect questions were false. The items were selected such that a group of Yale undergraduates who had not read the material answered the questions with chance accuracy, viz., scored at about 50 per cent.

Procedure

Each subject studied both the linguistics material and the African material, one in the original text form and the other in the summary form. Subjects in Experiment 1 studied the text for 20 minutes and the summary for 20 minutes. Some subjects complained that 20 minutes was not sufficient time to read the text; so in Experiment 2, subjects were given 30 minutes to study each type of material. Whether subjects studied the text material first or the summary material first was randomly determined as was the assignment of the topics to the two study conditions.

Subjects were given the reading matter to study in a small, private cubical that contained a video terminal connected to a PDP 11/40 computer. The terminal indicated to the subjects how much study time was left.

After studying each topic, subjects were tested with a series of 16 statements. These 16 statements were composed of four indirect true, four indirect false, four direct true and four direct false as defined earlier. Thirty-two questions were constructed, but only half of each type were (randomly) selected to be tested immediately after studying. The other half were tested one week later. Reaction times were surreptitiously recorded from the onset of the statement until the subject responded as to whether the assertion was true or not as defined by the material studied. In calculating mean reaction times, latencies greater than 20 seconds were truncated to 20 seconds. This was done to avoid the distorted means that might arise if a subject sat and thought for minutes about a question.

After answering questions about the first topic studied, subjects studied the second topic. When subjects were brought back a week later to answer the remaining 16 questions on each topic, they were tested on the two sets in the same order as they had been studied. Order of statements in both the initial testing and the delayed test were randomized.

Subjects

Thirty-nine subjects were tested in Experiment 1 and twenty-four in Experiment 2. They were recruited from the undergraduate population at Yale and served either to earn credit in the introductory psychology course or to earn \$5.00. The experiments were run in two sessions. The first lasted an hour or more. The second, a return test one week later, lasted about ten minutes.

Results

Table 1 presents the results from the two experiments. There is a slight advantage for subjects who studied the material for 30 minutes, but the pattern is essentially the same. In fact, subjects are only 1.8 % better in Experiment 2 for the ten extra minutes of study time.

Therefore, we will present the data of all 63 subjects averaged together. Table 2 presents the data collapsed over Experiments 1 and 2, but partitioned into immediate and delay conditions. Each cell of the matrix represents 252 observations. An analysis of variance was performed on the data using as factors subjects, form of study (text vs. summary), truth (true vs. false), question type (direct vs. inference) and delay. The standard error of the means in Table 2, based on the overall subject-by-condition interaction is 2.9%.

 Insert Table 1 about here

There are significant effects of study $F(1,38)=15.13$; $p<.001$, and delay, $F(1,38)=16.53$; $p<.001$. The advantage of summary over prose does not seem to diminish with delay. The overall effect of truth is not significant and we will collapse over it since differences between true and false may only reflect response biases.

 Insert Table 2 about here

There is a sizable interaction between the dimensions of study and statement type, $F(1,38)=8.00$, $p<.01$, such that subjects answer direct questions better than indirect questions when the material is studied in summary form, but answer indirect questions better when the material is learned in the original text form. However performance on indirect questions is better for material learned in summary form than in prose form, i.e., there is a clear main effect of type of study over and above the interaction.

Table 2 also presents the judgment times (in seconds). These data were analyzed using the same factors as the percent correct data. The same pattern of results obtains, although the differences are not all reliable. Subjects were significantly faster in responding at a delay, $F(1,38)=5.38$, $p<.05$. Subjects were also faster to answer direct questions than indirect, $F(1,38)=58.77$, $p<.001$. Subjects seem to be faster somewhat to answering questions about material studied in summary form, but this result is not reliable.

Table 3 partitions the data by type of material, viz., whether it was the linguistics chapter

or the African economic geography chapter. Subjects seem to do better on the linguistics chapter than they do on the African chapter, however the same pattern of results obtains for both chapters.

Insert Table 3 about here

EXPERIMENT 3

Experiments 1 and 2 equated the summary and text material on study time in order to assess which means was best for communicating main points. The conclusion seemed to be a clear victory for the summaries with an overall accuracy of 75.2% as compared with an accuracy of 65.3% for material studied in text form. However, the question of retention seems to be at least as theoretically interesting as initial acquisition and it occurred to us that prose might show a better retention function.

In order to discover whether material acquired from original texts would be more resistant to forgetting, we needed to equate initial performance. With this in mind, we ran a third experiment giving subjects only 15 minutes to study the summaries and 45 minutes to study the text. In other respects, the procedures and materials were identical with the first two experiments. The experiment used 31 subjects recruited from the same population as before and they could receive either credit or \$5.00 payment.

Results

Table 4 provides the percent recall data from the experiment as a function of form of study, type of question and delay. The difference between summary and text is only 2.5% in immediate test as compared with 11.7% in Experiments 1 and 2. These data were analyzed in the same way, using the same factors as the data from Experiments 1 and 2. The standard error of the means is 4.27.

There is no longer a significant difference between summary and text in the immediate

condition, although there is still a slight advantage for material studied in summary form. Now one can ask whether the text material is better retained. There is no significant interaction of delay with type of study (although there is a significant effect of delay-- $F(1,30)=20.22$; $p<.001$). The extent to which one can claim that one type of study yields better retention, however, indicates that material studied in summary form is remembered ^{better} longer.

Insert Table 4 about here

In Experiments 1 and 2, it was noted that there was an interaction between type of question asked and study form. In those experiments, the interaction seemed to diminish slightly with delay, but there was not a significant 3-way interaction with delay. In the current experiment, the interaction is only present in the immediate condition, but the effect disappears in the delayed condition. Indirect questions are not answered as well as direct questions for material studied in text form either.

Table 4 also presents the judgment times for this experiment. The times are considerably faster at a delay, $F(1,30)=16.97$; $p<.001$, and slower for indirect statements, $F(1,30)=34.05$; $p<.001$. There were no other significant effects.

Discussion

So far, the data have not indicated any instance where subjects perform better having studied the original text than having studied a summary of it. There was scant evidence that indirect questions are answered better than direct questions when material is studied in text form. However, this effect was weak statistically and not so large absolutely to cause a reversal with the summary condition. There may be a temptation to attribute the poor performance in the text condition to the particular materials chosen. For instance, perhaps the texts were poorly written. This seems unlikely as these texts have been adopted in a number of college courses. There is also at least one published study (Newsom and Gaiter, 1971) that has also found better memory for text material (in a somewhat different paradigm).

Nonetheless, to ensure that these results could not be accounted for totally by inherent

properties of the materials used, an experiment was performed that removed the memory component from the task. This would indicate to what extent the results could be attributed to the ease of question answering from the two sets of materials. Later experiments would explore further the generalizability of the results to other materials.

Experiment 4

Subjects were given the same questions to answer in this experiment as other subjects were given in previous experiments. They were also given the same materials, viz., one chapter in the original text form and one in the summary form. The principal difference was that the material they were to study was before them while answering the questions and they were encouraged to go back and look up any answer about which they were uncertain. The goal of this experiment was to eliminate the memory component of the task, and discover how much of the difference between the two study conditions was attributable to ease of discerning the relevant information from the study material.

It should be pointed out that this procedure does not really eliminate the role of memory in the task. Subjects were told to read the material first before answering the questions. They did this, but tended not to look back at the passage to answer the questions. After a few pilot subjects were run, a decision was made to pay subjects for correct responses and penalize them for incorrect answers in order to motivate them to look back through the material. Even with a monetary incentive, subjects did little hunting. In any case, the results from this experiment give some idea of the extent to which the results can be attributed to comprehension rather than memory failure.

Subjects

Twenty subjects were recruited from the Yale undergraduate population for an experiment that lasted under two hours. They were paid \$2.50 plus a bonus of \$.05 for each question they answered correctly.

Procedure

The same materials were used as in Experiments 1--3. However, subjects were given unlimited time to read the study material. After reading through the material to their satisfaction, they were given the 32 statements for that topic on a sheet of paper and were encouraged to go back and check their judgments about the truth of these statements. It was emphasized that it was important to be certain about their judgments and to find the supporting information when necessary. Subjects did search through the material at least some of the time. Each subject read both topics, one in text form and one in summary form. All possible orders of topics and conditions (four possible) were used equally often.

RESULTS and DISCUSSION

Table 5 presents mean accuracy for direct and indirect questions on material read in summary form and in text form. Subjects did not do all that well even with the text in front of them. This caused us to doubt whether our designated "correct" answers were always correct. In an informal study, with a few subjects, we pointed to the portions of the text from which the questions were taken. We obtained over 95% agreement with our subjects in this case. The subjects' problem in this study was that they did not know which portion of the text was relevant to the question. Thus, it is clear that in all conditions subjects are making errors primarily because they are not always searching when and where they should (c.f. Hayes-Roth and Walker, in press).

Insert Table 5 about here

It is unclear what portion of the subjects failure in the memory conditions is due to similar factors. Perhaps they had the information committed to memory for answering the question but failed to recall it in response to the question. This seems particularly plausible with respect to the indirect questions.

In any case, we took the conservative option of assuming that every time the subject failed in this experiment he would have failed in a memory experiment. We corrected the performance from the previous experiments with the data from this experiment under this

conservative assumption. We assumed that failure to recall in the previous experiments was a mixture of failure to notice the relevance of information in memory and "true memory failure." Let p_n be the probability of failure to notice relevance of information. This can be estimated as twice the error rate (the error rate is 1 minus probability correct in Table 5). Let p_o be the observed probability of failure to recall in experiments 1 and 2 (similarly estimated from Table 2), and p_m be the probability of a memory failure. The relation between these probabilities is

$$p_o = p_n + (1 - p_n)p_m$$

and so p_m can be estimated

$$p_m = \frac{p_o - p_n}{1 - p_n}$$

Table 6 gives the estimated probabilities of a memory success ($1 - p_m$) for Experiments 1 and 2.

Insert Table 6 about here.

The pattern obtained by analyzing the data correcting for guessing or correcting for performance "without memory demands" tells much the same story as before. Subjects can answer questions better if they have the summary material before them. The estimate of differential performance without memory constraints undoubtedly contains effects due to memory. Subjects often did not look back to the materials when answering questions, and they did not get all answers correct. Therefore correcting memory data by dividing by the results from this control experiment will attenuate a real difference. Nonetheless, there still remained an advantage for the summary condition.

EXPERIMENT 5

The data do not support the notion that the reason details are included in a text is to ^{enable} ~~make~~ readers better retain the central points of a passage. Conceivably a more subtle benefit

might accrue with the inclusion of details. Details provide the reader with a richer, more elaborate structure of the knowledge and perhaps this elaborated structure helps that person better acquire subsequent information. This hypothesis can be tested by looking at the extent to which subjects perform better on learning a set of facts when other *related facts*, learned previously, were acquired in text form rather than summary form.

New materials were used in this experiment for several reasons. First, the experiment required text book chapters that could be easily split in half so that one half could be learned in one form (text vs. summary) and the other half in the other form. Second, this provided a test of the replicability of previous results with new materials.

Method

Subjects

Thirty-two subjects from the Yale University community were recruited during the summer session. They were paid \$7.50 for their participation.

Materials

Again, introductory textbooks were used. One chapter dealt with the money supply taken from an introductory economics text called Macro Economics by Lloyd Reynolds, (1976), the other chapter, on the Russian Revolution, is from a history text called Russia: A short history by M. P. Florinsky, (1969). Both chapters have a natural stopping point in the middle which served to divide them in half. Subjects were asked questions about each half chapter after studying that material.

Again, summaries were written to restate the main points in as compact a fashion as possible. The section headings of the original text were retained, but there was no paragraph structure or interstitial material for the summaries. Only the critical sentences were typed on plain paper. Subjects received photo-copies of the original chapters in the

text condition. True-false questions were constructed with the constraint that they could be answered on the basis of the summaries alone. Since the important findings did not depend on the distinction between direct and indirect questions, the distinction was dropped for these topics. All questions were pre-tested and only selected if Yale undergraduates who had not read the material performed at chance (50% accuracy) on them. There were 20 questions, 10 true and 10 false for each half topic.

Procedure

Each subject studied both the economics and the history material. The second half of a topic was always studied after the first half. There were 16 different conditions in this experiment made by all possible combinations of summary or prose in the four half topics and the two possible orders, economics or Russian studied first. Two subjects were run in each condition.

Each half topic was studied for 30 minutes. Subjects were asked 20 questions immediately after reading each half.

Results

The data from this experiment are displayed in Table 7 averaged over order, truth, and type of text. Separate statistical analyses were done for the first text studied and the second. We will report the results of these analyses combined. Focus first on the top portion of the table. This lists the overall performance for the combined halves of both topics studied in summary form and studied in text form. Once again, there is an advantage for the summary condition although the effect seems a little weaker. The effect is nonetheless significant ($t_{96} = 2.80$).¹ The fact that the effect is not as large may be due to a difference in the materials selected.

Insert Table 7 about here.

The middle portion of the table presents the results of major interest. It displays the

proportion correct on the second half of each topic as a function of how the second half was studied and as a function of how the first half was studied. There is a marginally significant interaction ($t_{96} = 1.61$) such that a person is better off studying the second half in the same form as the first half was studied. Over and above this, however, there is no advantage for having studied the first half in prose form as we had anticipated. If anything, there is an advantage here too for having learned material in summary form (but clearly not significant-- $t_{96} = .92$). That is, not only does one learn information better when it is studied in summary form, there is some indication that one acquires new information better when prior related material has been studied in summary form.

The bottom part of Table 7 breaks down performance into the specific topics used. In both cases, performance is better in summary form, but the advantage seems to be greater with the history material. This finding is not too surprising in that the history text has a more diffusive style. In other words, the economics text is written in a rather summary-like style.

EXPERIMENT 6

Some of the advantage for the summary conditions might be due to the fact that subjects' perceptions of the critical points differ from the writers of the summaries and therefore in the text condition they are not focusing on the facts to be tested. Kintsch (personal communication) has found in the past that students' note-taking of his lectures reveals a different organization of ideas such that different points are considered the central ones.

In order to test the notion that the advantage of the summary condition was due to subjects inability to isolate what we thought the important points in the text, we replicated the last experiment and underlined the main points in the text. In all other respects, the two experiments were identical. All the points in the summaries could be found in the text and these main points were underlined on the photo-copies of the chapters. Thirty subjects were taken from the same population.

Results

The results from this experiment are presented in Table 8. The top portion of the table gives the means for the two critical conditions collapsed over materials and halves of chapters. The effect of type of study is attenuated ($t_{90} = 1.69$), but the advantage for summaries remains. The fact that the effect is smaller should not be surprising in that some subjects may have simply read the underlined portions of the text material, i.e., treated the text condition as if it were the summary condition.

 Insert Table 8 about here

The center portion of the table presents the critical analysis. Again there is an interaction such that subjects perform best learning the second half in the same mode that they learned the first half ($t_{90} = 1.53$). Combined, these two experiments yield a significant interaction between first and second form ($t_{186} = 2.22$). There was also a margin of significant advantage in this experiment of having studied the earlier text in summary form ($t_{90} = 1.75$). In combination, the two experiments also display a marginally significant effect in that direction ($t_{156} = 1.89, p < .1$; two-tailed).

EXPERIMENT 7

Having been unable to find an advantage for prose in any circumstance, we made one last attempt to see if perhaps the long-range retention of prose might not be superior to acquisition from summaries. We brought back as many subjects as we could from Experiments 1, 2 and 3. The original three experiments had been performed from January through May of 1977 while the retention tests were administered from November 1977 through May 1978. Thus, the delays varied from 6 to 12 months. The variation in delay is not serious as each subject serves as his own control. We constructed new true-false questions on the same chapters and verified with pilot subjects that these too are answered at chance by Yale undergraduates who have not studied the material.

Method

Subjects

It was not possible to achieve even a 50% return rate. Some subjects had left Yale, others were impossible to contact, and still others refused to return. Of the 39 subjects in Experiment 1, there were 16 returns; of the 24 in Experiment 2, there were 16 returns, and of the 31 in Experiment 3, there were 18 returns.

Materials

New true-false questions were created for both topics used in the experiments. Unlike the original set, no distinction was made between direct and indirect questions. But like the original questions, they were tested on pilot subjects who had not read the materials to assure that they would have only 50% (chance) accuracy of a correct response.

Procedure

Subjects were not told prior to their return why we needed them for our experiment. That is, we did not tell them that they would be asked more questions on the material they studied. In this way, we hoped to minimize any rehearsal prior to the retention test.

As in the original three experiments, the questions were presented to the subject via computer-driven CRT screen. They were tested on the two sets of material in the same order as originally studied. It was carefully explained to the subjects that they were still to try judge the truth of these statements with respect to the material that they had originally studied. While many subjects claimed to remember little or nothing from the original study episode, it was at least the case that they were able to remember which material was studied in summary form and which in text form.

Results

The results from this experiment are presented in Table 9 along with the comparable data from Experiments 1, 2 and 3 using only the data of those subjects we were able to bring

back. The data are presented for summary and text conditions as a function of the three levels of delay, viz., immediate test, test at one week and test at 6-12 month delay.

 Insert Table 9 about here.

Even at a delay of up to one year, there is still some advantage for the summary condition. There is an interaction between study form and delay, $F(4, 188) = 2.68$; $p < .05$, and the difference between the text condition and the summary condition is not significant at the longest delay. These effects may be due to the fact that performance is approaching the "floor" which is 50 per cent. That is, the interaction and the lack of a significant difference might be due to the fact that true differences can not be manifest since performance using percent correct can not go any lower.

GENERAL DISCUSSION

The data from seven experiments have been presented all of which argue that learning material from summaries is at least as good as reading the original text. People's ability to recognize important facts about a topic after studying it regardless of the delay between study and test is superior when the information is learned from a summary. New information is learned better (measured by one's ability to answer questions) if information learned earlier on a related topic was learned by reading a summary.

Our initial expectation was that the embellishments would improve retention since they provide a redundant coherent structure. Apparently the total time law and the notion of having to time share between main points and details is a more accurate way of understanding the situation. It is possible that subjects are providing their own embellishments while studying the summaries, but that is pure speculation. The fact that texts do not have a retention advantage over summaries is something of a consternation for our elaboration analysis of memory. Of course, because of the uncontrolled structure of textbooks, the reasoning is loose that goes from the elaboration hypothesis to a prediction of

an advantage for textbooks. We plan to follow up these results with experimentation on more carefully controlled material.

There are undoubtedly other desired outcomes besides fact learning that are intended from studying a text. Conceivably, a text serves these other purposes better than would a summary. Some of these were mentioned in the introduction.

It had occurred to us that some subjects might benefit more from reading summaries than other subjects. In fact, there is some evidence (Pask and Scott, 1972) that different groups of people learn the same set of material better when it is structured in a manner consistent with their respective competencies. It seemed reasonable to suppose that poor readers might benefit more from reading summaries than good readers who can discern the important information from the text. To test this notion, the data from Experiments 1 and 2 were divided in half such that the subjects with the highest accuracy were in one group and subjects with the worst accuracy in the other. We then reanalyzed the data for each group to see if the pattern of summary versus text study conditions would be different for the good and bad subjects. We found no difference in pattern. So it seems that the findings of better performance when reading summaries generalizes to all types of people regardless of their scholastic aptitude.

In case you, the reader of this paper, are now concerned that you will have trouble retaining the central results and conclusions of this paper, a summary version (Reder, 1979) is available upon request.

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Footnotes

¹ Because of the nature of our design, we had to do separate analyses for the two topics read by a given subject. Other within-subjects factors had to be treated as between and due to experimenters' error, we do not have equal Ns in each condition.

Table 1

Proportion Correct on Questions from
Experiments 1 and 2 as a function of type of study
and type of question.

Experiment 1		20 min.	
Summary			Text
Direct	.772		.625
Indirect	.720		.659
Experiment 2		30 min.	
Summary			Text
Direct	.789		.638
Indirect	.732		.691

Table 2

Accuracy and Latency Performance on Questions
from Experiments 1 and 2 as a function of type of
question, type of study, and delay.

	Proportion Correct			
	Immediate		<i>Delay</i>	
	Summary	Text	Summary	Text
Direct	.839	.651	.718	.607
Indirect	.752	.707	.700	.647

	Reaction Time -- secs.			
	Immediate		<i>Delay</i>	
	Summary	Text	Summary	Text
Direct	10.64	11.64	10.84	11.13
Indirect	12.86	12.80	11.84	11.86

Table 3

Proportion Correct in Experiments 1 and 2
partitioned by material studied.

	Immediate		<i>Delay</i>	
	Summary	Text	Summary	Text
Africa	.752	.611	.684	.551
Linguistics	.841	.738	.731	.701

Table 4

Accuracy and Latency Performance on Questions from
Experiment 3 as a function of type of study,
type of question, and delay.

Proportion Correct				
	Immediate		Delay	
	Summary	Text	Summary	Text
Direct	.76	.68	.68	.65
Indirect	.73	.76	.67	.59

Reaction Time -- secs.				
	Immediate		Delay	
	Summary	Text	Summary	Text
Direct	11.13	11.09	9.48	10.27
Indirect	12.45	12.58	11.01	11.35

Table 5

Accuracy on Questions with "no
Memory Requirement"

	Summary	Text
Direct	.85	.78
Indirect	.80	.72

Table 6

Estimated Probabilities of Memory Success using
Corrected Memory Scores

	Immediate	Delay
Summary	.91	.64
Text	.72	.51

Table 7

Estimated probabilities of memory success using Corrected Memory Scores
Divided by Corrected "absolute" Scores.

Performance averaged over both halves

Summary	Text
.758	.704

Performance on second half as a
function of study form on first half

Current Form	Previous Form		Average
	Summary	Text	
Summary	.782	.721	.752
Text	.714	.737	.726
Mean	.748	.729	.739
History Economics	Summary	Text	
	.79 .73	.72 .70	

Table 8
Proportion correct in Experiment 5: Transfer Experiment
with the Main Points Underlined

Performance over both halves

Summary	Text
.734	.718

Performance on second half
as a function of study form on first half

Previous Form Studied

Current Form	Summary	Text	Mean
Summary	.767	.687	.727
Text	.758	.717	.738
Mean	.763	.702	

Table 9

	Proportion Correct for subjects in Experiments 1, 2, 3 who participated in Experiment 9.	
	Summary	Text
Immediate	.793	.693
1 week	.675	.600
6 mo./1 yr.	.595	.575

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